

FORM PTO-1190 (Modified) (REV. 11-2000)		DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 06007/38331	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 10/089947	
INTERNATIONAL APPLICATION NO. PCT/GB00/02853		INTERNATIONAL FILING DATE 25 July 2000		PRIORITY DATE CLAIMED 7 Oct. 1999	
TITLE OF INVENTION HYDRAULIC SYSTEM FOR AIRCRAFT LANDING GEAR					
APPLICANT(S) FOR DO/EO/US Colin Robert Gedge et al					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none">1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2))<ol style="list-style-type: none">a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).b. <input checked="" type="checkbox"/> has been communicated by the International Bureau.c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).<ol style="list-style-type: none">a. <input checked="" type="checkbox"/> is attached hereto.b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))<ol style="list-style-type: none">a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).b. <input checked="" type="checkbox"/> have been communicated by the International Bureau.c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.d. <input type="checkbox"/> have not been made and will not be made.8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). In Blank10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).11. <input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409).12. <input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210).					
Items 13 to 20 below concern document(s) or information included:					
<ol style="list-style-type: none">13. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.15. <input type="checkbox"/> A FIRST preliminary amendment.16. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.17. <input type="checkbox"/> A substitute specification.18. <input type="checkbox"/> A change of power of attorney and/or address letter.19. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.20. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).21. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).22. <input checked="" type="checkbox"/> Certificate of Mailing by Express Mail23. <input checked="" type="checkbox"/> Other items or information: PCT Forms 101; 210; 301; 304; 332; 401; 409; WIPO Publication No. WO/01/25087 A1; General Authorization					

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 10/0899947	INTERNATIONAL APPLICATION NO PCT GB00/02853	ATTORNEY'S DOCKET NUMBER 06007/38331
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24. The following fees are submitted:				CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :					
<input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO				\$1040.00	
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO				\$890.00	
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO				\$740.00	
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)				\$710.00	
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)				\$100.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$1040.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$0.00	
CLAIMS		NUMBER FILED	NUMBER EXTRA	RATE	
Total claims		- 20 =	0	x \$18.00	\$0.00
Independent claims		- 3 =	0	x \$84.00	\$0.00
Multiple Dependent Claims (check if applicable).				<input checked="" type="checkbox"/>	280.00
TOTAL OF ABOVE CALCULATIONS =				\$1320.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				\$0.00	
SUBTOTAL =				\$1320.00	
Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$1320.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).				<input type="checkbox"/>	\$0.00
TOTAL FEES ENCLOSED =				\$1320.00	
				Amount to be refunded	\$
				charged	\$

- a. ☒ A check in the amount of \$1,320.00 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No 13-2855 A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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6300 Sears Tower
233 South Wacker Drive
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Telephone: 312/474-6300
Telecopy: 312/474-0448

~~SIGNATURE~~

Richard B. Hoffman

NAME _____

26,910

REGISTRATION NUMBER

DATE April 3, 2002



5000

JC14 Rec'd PCT/PTO 06 MAY 2002

PATENT
06007/38331

PCT

THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:

Gedge, *et al.*

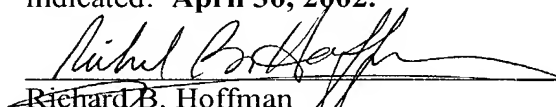
Serial No.: 10/089,947

Title: HYDRAULIC SYSTEM FOR
AIRCRAFT LANDING GEAR

Filed: April 3, 2002

Group Art Unit: Unknown

Examiner: Unknown

) I hereby certify that this paper is being
) deposited with the United States Postal
) Service, first class postage prepaid,
) addressed to: Commissioner for Patents,
) Washington, D.C. 20231, on the date
) indicated: **April 30, 2002.**
) 
) Richard B. Hoffman
) Registration No. 26,910
) Attorney for Applicants
)
)
)

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In connection with the subject patent application, please enter the following amendment:

IN THE SPECIFICATION:

At page 1, after the title, please delete Description of Invention and add a new centered heading as follows:

Field of the Invention

At page 1, please delete the entire first paragraph, and substitute with the following:

This invention relates to a hydraulic system for raising and lowering an aircraft landing gear, and more particularly but not exclusively useful for a kind of aircraft landing gear known as a side brace, where the landing gear is movable between a generally vertical

condition for landing, and a generally horizontal condition for stowage e.g. within a wing of the aircraft.

Page 1, after first full paragraph, please add a new centered heading as follows:

Background of the Invention

Page 1, after third full paragraph, please add a new centered heading as follows:

Summary of the Invention

At page 1, please delete the entire fourth paragraph, with carryover to page 2, and substitute with the following:

According to one aspect of the invention we provide a hydraulic system for raising and lowering aircraft landing gear, the system including an actuator which is extendible and retractable to operate the landing gear, the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member while fluid is exhausted from the first side of the movable member, and there being selector valve means selectively to supply pressurized fluid to the first or second side of the movable member, and means provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

At page 3, please delete the third full paragraph, and substitute with the following:

The selector valve means may be movable to a first position to permit the flow of fluid therethrough from a source of pressurized fluid to the first side of the movable member,

and to a second position to permit the flow of fluid therethrough from the source to the second side of the movable member, and to a rest position in which the source is isolated and fluid may pass from the system to tank.

At page 4, after second full paragraph, please insert a new centered heading as follows:

Brief Description of the Drawings

At page 5, after description of FIGURE 3, please insert a new centered heading as follows:

Detailed Description of the Invention

Page 5, please delete fourth full paragraph, and substitute with the following:

The landing gears 11, 12 are operable by means of respective actuators 18 which are extendible and retractable by means of pressurized hydraulic fluid.

Page 5, please delete sixth full paragraph, and substitute with the following:

When pressurized hydraulic fluid is supplied to a head end 11 of the actuator 18 at a first side of the piston 19, the piston 19 moves in the cylinder 20 so as to extend the actuator 18, at the same time forcing fluid at a second opposite side of the piston 19, to be exhausted from an actuator rod end 23 of the actuator 18. Conversely, when pressurized fluid is supplied to the actuator rod end 23 of the actuator 18, the piston 19 moves in the cylinder 20 so as to retract the actuator 18, at the same time forcing fluid to be exhausted from the head end 22.

Page 6, please delete the first full paragraph, and substitute with the following:

The selector valve means 25 is movable between three positions in this example. When in a first raised position, i.e. when a spool 29 thereof is in the position indicated in the drawings at I, pressurized fluid is supplied to a first supply line 30 which extends to the head

end 22 of the actuator 18. In the first supply line 30 there is a flow regulating means 31 which controls the pressure of fluid which is supplied to the head end 22 of the actuator 18. Also there is a by-pass one way valve 32 which enables fluid from the first supply line 30 to flow freely to tank 27 as hereinafter described.

Page 6, please delete the second full paragraph, and substitute with the following:

When the spool 29 of the selector valve means 25 is in an intermediate or rest position as shown and indicated at R, the pressurized fluid source i.e. pump 26 is isolated from the actuator 18 and moreover fluid may flow from the first supply line 30 as well as from a second supply line 34 to be described, back to tank 27.

Page 6, please delete the third full paragraph, and substitute with the following:

When the spool 29 of the selector valve means 25 is in a second lowered position as indicated at II in figure 2, pressurized fluid is fed from the pump 26 to a second supply 34 which extends to the rod end 23 of the actuator 18. The second supply line 34 includes a one way valve 35 through which pressurized fluid may freely flow to the rod end 23 of the actuator 18, and a by-pass restrictor 36 which allows fluid to by-pass the one way valve 35 as hereinafter described.

Page 7, please delete the fifth full paragraph, and substitute with the following:

Typically, a mechanical or other sensing arrangement is provided which may interface with an interlock which operates mechanically to retain the landing gear in its fully lowered condition and may cause the selector valve means 25 to assume the rest position R once the landing gear 11 or 12 is fully lowered. In the rest condition R, fluid may flow from the first and second supply lines 30, 34 to tank 27 so that the system is unpressurized when the landing gear 11 or 12 is in a fully lowered condition and the pump 26 is indicated.

Page 8, please delete the first full paragraph, and substitute with the following:

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When it is desired to raise the landing gear 11 or 12 the selector valve means 25 may be moved to the second position II in which pressurized fluid is fed to the second supply line 34 through the one way valve 35 to the rod end 23 of the actuator 28, and the piston 19 will be moved to begin retraction of the landing gear 11 or 12. When there is an interlock mechanically to retain the landing gear in a lowered condition, this needs to be released before the piston 19 can move. Such release may be arranged to occur simultaneously with selector valve means 25 movement.

Page 8, please delete the third full paragraph, and substitute with the following:

As the landing gear 11 or 12 fully retracts, an uplock may be operated mechanically to hold the landing gear in its raised condition. At the same time, the selector valve means 25 may be moved to the rest position R so that again, the hydraulic system is unpressurized when the landing gear 11 or 12 is in its stowed condition.

At page 10, please delete the last paragraph with carryover to page 11, and substitute with the following:

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination be utilized for realizing the invention in diverse forms thereof.

IN THE CLAIMS:

Please delete Claims at top of page.

At line 1, before claim 1, please insert We Claim.

1 (Amended). A hydraulic system for raising and lowering aircraft landing gear, the system including an actuator which is extendible and retractable to operate the landing gear,

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the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member while fluid is exhausted from the first side of the movable member, and there being a selector valve selectively to supply pressurized fluid to the first or second side of the movable member, and wherein a valve is provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

2 (Amended). A system according to claim 1 wherein the valve is a check valve which is opened as the movable member of the actuator moves relatively in the casing in the first direction to extend the actuator and lower the landing gear.

3 (Amended). A system according to claim 2 wherein the check valve opens to permit exhausted fluid from the second side of the movable member to augment the supplied fluid in response to one of the pressure of the fluid supplied to the first side of the member or a pressure build up in a passage carrying exhausted fluid from the second side of the movable member.

4 (Amended). A system according to claim 2 wherein a closure device is provided positively to close the check valve when pressurized fluid is supplied by the selector valve to the second side of the movable member.

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5 (Amended). A system according to claim 1 wherein a relief device is provided to relieve exhausted fluid which is not recirculated from the at least one of the first and second sides of the movable member as the movable member reaches the end of travel in the casing.

6 (Amended). A hydraulic system according to claim 1 including a first fluid supply line to the first side of the movable member for supplied fluid from the selector valve when the selector valve is in a first position, and a second supply line to the second side of the movable member for supplied fluid from the selector valve when the selector valve is in a second position, and the relief device which permits exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve and thus be directed with the supplied fluid, to the second or first side respectively of the movable member, permitting the exhausted fluid to flow from the second supply line to the first supply line.

7 (Amended). A system according to claim 6 wherein the second supply line includes a non return valve at least to restrict the flow of exhausted fluid from the hydraulic system.

8 (Amended). A system according to claim 7 wherein a restrictor device is provided to enable a restricted flow of exhausted fluid which is not recirculated to by-pass the non-return valve.

9 (Amended). A system according to claim 1 wherein the selector valve is movable to a first position to permit the flow of fluid therethrough from a source of pressurized fluid to the first side of the movable member, and to a second position to permit the flow of fluid therethrough from the source to the second side of the movable member, and to a rest position in which the source is isolated and fluid may pass from the system to tank.

Please cancel claim 10 without prejudice.

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11 (Amended). An aircraft having landing gear which is raised and lowered by a hydraulic system including an actuator which is extendible and retractable to operate the landing gear, the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member while fluid is exhausted from the first side of the movable member, and there being a selector valve selectively to supply pressurized fluid to the first or second side of the movable member, and wherein a valve is provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

12 (Amended). A valve including a valve member and a piston each received in a passage in a valve body, the valve member and piston being biased apart by a spring such that the valve member is urged towards a valve seat towards one end of the passage, and the piston is urged towards a stop towards an opposite end of the passage, a fluid inlet and a fluid outlet, the pressure of fluid at the inlet when sufficient, acting to move the valve member against the force of a spring off the valve seat to permit fluid flow from the inlet, past the valve seat, to the outlet, and the piston being movable in the passage away from the stop in response to a pilot pressure delivered to a pilot pressure port of the body against the force of the spring to a position in the passage in which the piston engages the valve member and restrains the valve member against movement off the valve seat in response to the inlet pressure.

13 (Amended). A valve according to claim 12 wherein a channel is provided to permit fluid pressure at the outlet to be communicated to an intermediate region of the passage between the valve member and the piston at least when the piston is engaged with the stop.

14 (Amended). A valve according to claim 13 wherein the outlet opens into the valve passage and there is a flow path for the fluid under at the outlet past or through the valve member to the intermediate region when the valve member is in engagement with the valve seat.

15 (Amended). A valve according to claim 12 wherein the valve is a check valve to permit the flow of exhausted fluid from at least one of the first and second sides of a movable member of an actuator of a hydraulic system which includes an actuator which is extendible and retractable to operate landing gear of an aircraft, the actuator including a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member while fluid is exhausted from the first side of the movable member, and there being a selector valve selectively to supply pressurized fluid to the first or second side of the movable member, and wherein a valve is provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve and thus be directed with the supplied fluid, to the second or first side respectively of the movable member to augment the supplied fluid from the selector valve and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

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Please cancel claims 16 and 17 without prejudice.

REMARKS

The claims have now been reviewed and amended to conform to U.S. practice, but have not been narrowed. The specification has been given headings and spellings corrected, and a substitute Abstract has been provided on a separate sheet. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made".

It is respectfully submitted the application as amended above is now in condition for substantive examination on the merits. If any claim or other fees are due by this Amendment, please charge our deposit account No. 13-2855.

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Respectfully submitted,

Colin Robert Gedge et al, Applicants

Date: April 30, 2002


Richard B. Hoffman, Reg. No. 26,910
Attorney for Applicants

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Telephone: 312/474-6300

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

At page 1, after the title, please delete Description of Invention and add a new centered heading as follows:

--Field of the Invention--

At page 1, please delete the entire first paragraph, and substitute with the following:

This invention relates to a hydraulic system for raising and lowering an aircraft landing gear". The invention is", and more particularly but not exclusively useful for a kind of aircraft landing gear known as a side brace, where the landing gear is movable between a generally vertical condition for landing, and a generally horizontal condition for stowage e.g. within a wing of the aircraft.

Page 1, after first full paragraph, please add a new centered heading as follows:

--Background of the Invention--

Page 1, after third full paragraph, please add a new centered heading as follows:

--Summary of the Invention--

At page 1, please delete the entire fourth paragraph, with carryover to page 2, and substitute with the following:

According to one aspect of the invention we provide a hydraulic system for raising and lowering aircraft landing gear, the system including an actuator which is extendible and retractable to operate the landing gear, the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member "whilst" while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure

is supplied to the second side of the movable member "whilst" while fluid is exhausted from the first side of the movable member, and there being selector valve means selectively to supply "pressurised" pressurized fluid to the first or second side of the movable member, "characterised in that" and means "are" provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

At page 3, please delete the third full paragraph, and substitute with the following:

The selector valve means may be movable to a first position to permit the flow of fluid therethrough from a source of "pressurised" pressurized fluid to the first side of the movable member, and to a second position to permit the flow of fluid therethrough from the source to the second side of the movable member, and to a rest position in which the source is isolated and fluid may pass from the system to tank.

At page 4, after second full paragraph, please insert a new centered heading as follows:

--Brief Description of the Drawings--

At page 5, after description of FIGURE 3, please insert a new centered heading as follows:

--Detailed Description of the Invention--

Page 5, please delete fourth full paragraph, and substitute with the following:

The landing gears 11, 12 are operable by means of respective actuators 18 which are extendible and retractable by means of "pressurised" pressurized hydraulic fluid.

Page 5, please delete sixth full paragraph, and substitute with the following:

When "pressurised" pressurized hydraulic fluid is supplied to a head end 11 of the actuator 18 at a first side of the piston 19, the piston 19 moves in the cylinder 20 so as to extend the actuator 18, at the same time forcing fluid at a second opposite side of the piston 19, to be exhausted from an actuator rod end 23 of the actuator 18. Conversely, when pressurized fluid is supplied to the actuator rod end 23 of the actuator 18, the piston 19 moves in the cylinder 20 so as to retract the actuator 18, at the same time forcing fluid to be exhausted from the head end 22.

Page 6, please delete the first full paragraph, and substitute with the following:

The selector valve means 25 is movable between three positions in this example.

When in a first raised position, i.e. when a spool 29 thereof is in the position indicated in the drawings at I, "pressurised" pressurized fluid is supplied to a first supply line 30 which extends to the head end 22 of the actuator 18. In the first supply line 30 there is a flow regulating means 31 which controls the pressure of fluid which is supplied to the head end 22 of the actuator 18. Also there is a by-pass one way valve 32 which enables fluid from the first supply line 30 to flow freely to tank 27 as hereinafter described.

Page 6, please delete the second full paragraph, and substitute with the following:

When the spool 29 of the selector valve means 25 is in an intermediate or rest position as shown and indicated at R, the "pressurised" pressurized fluid source i.e. pump 26 is isolated from the actuator 18 and moreover fluid may flow from the first supply line 30 as well as from a second supply line 34 to be described, back to tank 27.

Page 6, please delete the third full paragraph, and substitute with the following:

When the spool 29 of the selector valve means 25 is in a second lowered position as indicated at II in figure 2, "pressurised" pressurized fluid is fed from the pump 26 to a second supply 34 which extends to the rod end 23 of the actuator 18. The second supply line 34

includes a one way valve 35 through which "pressurised" pressurized fluid may freely flow to the rod end 23 of the actuator 18, and a by-pass restrictor 36 which allows fluid to by-pass the one way vale 35 as hereinafter described.

Page 7, please delete the fifth full paragraph, and substitute with the following:

Typically, a mechanical or other sensing arrangement is provided which may interface with an interlock which operates mechanically to retain the landing gear in its fully lowered condition and may cause the selector valve means 25 to assume the rest position R once the landing gear 11 or 12 is fully lowered. In the rest condition R, fluid may flow from the first and second supply lines 30, 34 to tank 27 so that the system is "unpressurised" unpressurized when the landing gear 11 or 12 is in a fully lowered condition and the pump 26 is indicated.

Page 8, please delete the first full paragraph, and substitute with the following:

When it is desired to raise the landing gear 11 or 12 the selector valve means 25 may be moved to the second position II in which "pressurised" pressurized fluid is fed to the second supply line 34 through the one way valve 35 to the rod end 23 of the actuator 28, and the piston 19 will be moved to begin retraction of the landing gear 11 or 12. When there is an interlock mechanically to retain the landing gear in a lowered condition, this needs to be released before the piston 19 can move. Such release may be arranged to occur simultaneously with selector valve means 25 movement.

Page 8, please delete the third full paragraph, and substitute with the following:

As the landing gear 11 or 12 fully retracts, an uplock may be operated mechanically to hold the landing gear in its raised condition. At the same time, the selector valve means 25 may be moved to the rest position R so that again, the hydraulic system is "unpressurised" unpressurized when the landing gear 11 or 12 is in its stowed condition.

At page 10, please delete the last paragraph with carryover to page 11, and substitute with the following:

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination be "utilised" utilized for "realising" realizing the invention in diverse forms thereof.

IN THE CLAIMS:

Please delete Claims at top of page.

~~-At line 1,-before claim 1,-please insert-We Claim.-~~

1 (Amended). A hydraulic system for raising and lowering aircraft landing gear, the system including an actuator which is extendible and retractable to operate the landing gear, the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member [whilst] while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member [whilst] while fluid is exhausted from the first side of the movable member, and there being a selector valve [means] selectively to supply [pressurised] pressurized fluid to the first or second side of the movable member, [characterised in that means are] and wherein a valve is provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve [means] and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

2 (Amended). A system according to claim 1 [characterised in that the means which permit exhausted fluid to augment the supplied fluid includes a] wherein the valve is a check valve which is opened as the movable member of the actuator moves relatively in the casing in the first direction to extend the actuator and lower the landing gear.

3 (Amended). A system according to claim 2 [characterised in that] wherein the check valve opens to permit exhausted fluid from the second side of the movable member to augment the supplied fluid in response to one of the pressure of the fluid supplied to the first side of the member or [in response to] a pressure build up in a passage carrying exhausted fluid from the second side of the movable member.

4 (Amended). A system according to claim 2 [or claim 3 characterised in that] wherein a closure [means are] device is provided positively to close the check valve when pressurized fluid is supplied by the selector valve to the second side of the movable member.

5 (Amended). A system according to [any one of the preceding claims characterised in that means are] claim 1 wherein a relief device is provided to relieve exhausted fluid which is not recirculated from the at least one of the first and second sides of the movable member as the movable member reaches the end of travel in the casing.

6 (Amended). A hydraulic system according to [any one of the preceding claims] claim 1 including a first fluid supply line to the first side of the movable member for supplied fluid from the selector [means] valve when the selector valve [means] is in a first position, and a second supply line to the second side of the movable member for supplied fluid from the selector valve [means] when the selector valve [means] is in a second position, and the [means] relief device which permits exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve [means] and thus be directed with the supplied fluid, to the second or first side respectively of the

7 (Amended). A system according to claim 6 [characterised in that] wherein the second supply line includes a non return [means] valve at least to restrict the flow of exhausted fluid from the hydraulic system.

9 (Amended). A system according to [any one of the preceding claims characterised in that] claim 1 wherein the selector valve [means] is movable to a first position to permit the flow of fluid therethrough from a source of [pressurised] pressurized fluid to the first side of the movable member, and to a second position to permit the flow of fluid therethrough from the source to the second side of the movable member, and to a rest position in which the source is isolated and fluid may pass from the system to tank.

11 (Amended). An aircraft having landing gear which is raised and lowered by a hydraulic system [according to any one of the preceding claims] including an actuator which is extendable and retractable to operate the landing gear, the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member while fluid is exhausted from the first and second sides of the movable member to augment the supplied fluid from

the selector valve and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

12 (Amended). A valve including a valve member and a piston each received in a passage in a valve body, the valve member and piston being biased apart by [resilient means] a spring such that the valve member is urged towards a valve seat towards one end of the passage, and the piston is urged towards a stop towards an opposite end of the passage, a fluid inlet and a fluid outlet, the pressure of fluid at the inlet when sufficient, acting to move the valve member against the force of [the biasing means] a spring off the valve seat to permit fluid flow from the inlet, past the valve seat, to the outlet, and the piston being ~~movable in the passage away from the stop in response to a pilot-pressure delivered to a pilot~~ pressure port of the body against the force of the [biasing means] spring to a position in the passage in which the piston engages the valve member and restrains the valve member against movement off the valve seat in response to the inlet pressure.

13 (Amended). A valve according to claim 12 [characterised in that means are] wherein a channel is provided to permit fluid pressure at the outlet to be communicated to an intermediate region of the passage between the valve member and the piston at least when the piston is engaged with the stop.

14 (Amended). A valve according to claim 13 [characterised in that] wherein the outlet opens into the valve passage and there is a flow path for the fluid under at the outlet past [and/]or through the valve member to the intermediate region when the valve member is in engagement with the valve seat.

15 (Amended). A valve according to [any one claims 13 to 14 characterised in hat] claim 12 wherein the valve is a check valve to permit the flow of exhausted fluid from at least one of the first and second sides of [the] a movable member of [the] an actuator of [the] a

hydraulic system [according to any one of claims 1 to 11] which includes an actuator which is extendible and retractable to operate landing gear of an aircraft, the actuator including a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member while fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member while fluid is exhausted from the first side of the movable member, and there being a selector valve selectively to supply pressurized fluid to the first or second side of the movable member to be directed with the supplied fluid, to the second or first side respectively of the movable member to augment the supplied fluid from the selector valve [means] and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

Please cancel claims 16 and 17 without prejudice.

JOINT INVENTORS

06007/38331

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Richard Zimmermann

**APPLICATION FOR
UNITED STATES LETTERS PATENT**

S P E C I F I C A T I O N

TO ALL WHOM IT MAY CONCERN:

Be it known that we, Robert Colin Gedge, a citizen of the United Kingdom, residing at 43 Pilsdon Drive, Canford Heath, Poole, Dorset B17 9EJ United Kingdom, and Andrew Bramwell, a citizen of the United Kingdom, residing at 5 Ashlands Meadow, Broadschard, Crewkerne, Somerset Ta 18 TNN United Kingdom, have invented a new and useful HYDRAULIC SYSTEM FOR AIRCRAFT LANDING GEAR, of which the following is a specification.

3/p1/1>

Title: Hydraulic System for Aircraft Landing Gear

Description of Invention

This invention relates to a hydraulic system for raising and lowering an aircraft landing gear. The invention is more particularly but not exclusively useful for a kind of aircraft landing gear known as a side brace, where the landing gear is movable between a generally vertical condition for landing, and a generally horizontal condition for stowage e.g. within a wing of the aircraft.

A particular feature of such side brace landing gears is that landing loads act through an actuator which is provided to raise and lower the landing gear. Accordingly such actuators have to be more substantial than would be required simply for raising and lowering the landing gear. Typically such actuators are piston and cylinder arrangements, and the piston diameter is made larger than is necessary just for raising and lowering the landing gear.

As a result, the actuator demands a large volume of hydraulic fluid for operation. Particularly during landing, when it is desired to lower the landing gear, other aircraft services will be demanding hydraulic fluid, for example flap lowering actuators may require fluid, which can place high demands on the hydraulic pump(s) supplying pressurised hydraulic fluid to the various services.

According to one aspect of the invention we provide a hydraulic system for raising and lowering aircraft landing gear, the system including an actuator which is extendible and retractable to operate the landing gear, the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member whilst fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member whilst

fluid is exhausted from the first side of the movable member, and there being selector valve means selectively to supply pressurised fluid to the first or second side of the movable member, characterised in that means are provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

By virtue of the system of the present invention, the demand on the hydraulic pump(s) is thus reduced during landing gear operation as exhausted fluid is recirculated to augment the fluid supply, thus reducing the volume of fluid required from the hydraulic pump(s) to operate the landing gear.

In one arrangement the means which permit exhausted fluid to augment the supplied fluid includes a check valve which is opened as the movable member of the actuator moves relatively in the casing in the first direction to extend the actuator and lower the landing gear.

The check valve may be adapted to open to permit exhausted fluid from the second side of the movable member to augment the supplied fluid in response to the pressure of the fluid supplied to the first side of the member or alternatively in response to a pressure build up in a line carrying exhausted fluid from the second side of the movable member. In each case preferably closure means are provided positively to close the check valve when pressurised fluid is supplied by the selector valve to the second side of the movable member.

Such closure means may be of a hydraulic and/or mechanical nature.

Preferably means are provided to relieve exhausted fluid which is not recirculated from the at least one of the first and second sides of the movable member as the movable member reaches the end of travel in the casing. Thus there is no risk of trapped fluid interfering with the proper operation of the landing gear.

In one arrangement the hydraulic system includes a first fluid supply line to the first side of the movable member for supplied fluid from the selector valve means when the selector valve means is in a first position, and a second supply line to the second side of the movable member for supplied fluid from the selector valve means when the selector valve means is in a second position, and the means which permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member, permitting the exhausted fluid to flow from the second supply line to the first supply line.

To ensure that exhausted fluid is available to augment the supplied fluid to extend the actuator, the second supply line may include non-return means at least to restrict the flow of exhausted fluid from the hydraulic system. However desirably a restrictor means is provided to enable a restricted flow of exhausted fluid to by-pass the non-return means so that fluid which is not recirculated, is not trapped in the second supply line which could interfere with the proper operation of the landing gear.

The selector valve means may be movable to a first position to permit the flow of fluid therethrough from a source of pressurised fluid to the first side of the movable member, and to a second position to permit the flow of fluid therethrough from the source to the second side of the movable member, and to a rest position in which the source is isolated and fluid may pass from the system to tank.

According to a second aspect of the invention we provide an aircraft having landing gear which is raised and lowered by a hydraulic system according to the first aspect of the invention.

According to a third aspect of the invention we provide a valve including a valve member and a piston each received in a passage in a valve body, the valve member and piston being biased apart by resilient means such that the

valve member is urged towards a valve seat towards one end of the passage, and the piston is urged towards a stop towards an opposite end of the passage, a fluid inlet and a fluid outlet, the pressure of fluid at the inlet when sufficient, acting to move the valve member against the force of the biasing means off the valve seat to permit fluid flow from the inlet, past the valve seat, to the outlet, and the piston being movable in the passage away from the stop in response to a pilot pressure delivered to a pilot pressure port of the body against the force of the biasing means to a position in the passage in which the piston engages the valve member and restrains the valve member against movement off the valve seat in response to the inlet pressure.

Means may be provided to permit fluid pressure at the outlet to be communicated to an intermediate region of the passage between the valve member and the piston at least when the piston is engaged with the stop. For example the outlet may open into the valve passage and there may be a flow path for the fluid at the outlet past and/or through the valve member to the intermediate region when the valve member is in engagement with the valve seat.

Such a valve in accordance with the third aspect of the invention may be a check valve to permit the flow of exhausted fluid from at least one of the first and second sides of the movable member of the actuator of the hydraulic system according to the first aspect of the invention to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

The invention will now be described with reference to the accompanying drawings in which:-

FIGURE 1 is a front illustrative view of an aircraft showing the landing gear thereof on one side in a lowered landing condition and the landing gear at the other side partly raised towards a stowed condition, the landing gear being operated by a hydraulic system in accordance with the invention.

FIGURE 2 is an illustrative view of a hydraulic system in accordance with the invention;

FIGURE 3 is a more detailed but illustrative view of a check valve for use in the system of figure 2.

Referring first to figure 1 of the drawings, an aircraft 10 has landing gear 11, 12 one at each side thereof, the landing gears 11, 12 each including a strut assembly 13 which carries a landing wheel 14, which strut assembly 13 is movable between a generally vertical lowered condition for landing, and a raised stowed condition in which the strut assembly 13 is generally horizontal and located within a wing 15 where the landing gear 11, 12 is stowed.

The landing gears 11, 12 are operable by means of respective actuators 18 which are extendible and retractable by means of pressurised hydraulic fluid.

Referring now to figure 2, a hydraulic system is shown. It can be seen that in this example each actuator 18 has a movable member or piston 19 in this example, which moves inside a casing or cylinder 20, as is well known in the art of hydraulic systems.

When pressurised hydraulic fluid is supplied to a head end 22 of the actuator 18 at a first side of the piston 19, the piston 19 moves in the cylinder 20 so as to extend the actuator 18, at the same time forcing fluid at a second opposite side of the piston 19, to be exhausted from an actuator rod end 23 of the actuator 18. Conversely, when pressurised fluid is supplied to the actuator rod end 23 of the actuator 18, the piston 19 moves in the cylinder 20 so as to retract the actuator 18, at the same time forcing fluid to be exhausted from the head end 22.

Hydraulic fluid is fed to the actuator 18 via a selector valve means 25 to which a source of fluid under pressure i.e. a hydraulic pump 26 is connected. The pump 26 draws hydraulic fluid for pumping, from a tank 27.

Fluid thus flows along the first supply line 30, through the flow regulating means 31 to the head end 22 of the actuator 18 and the piston 19 is caused to commence movement to extend the actuator 18 to lower the landing gear 11 or 12. Fluid flow from the rod end 23 of the actuator 18 is however restricted to a small flow through the by-pass restrictor 36 from where the exhausted fluid passes to tank 27 via the selector valve means 25.

Because exhausted fluid flow is thus restricted, pressure will build up in both the first and second 30,34 lines. This pressure build up results in the check valve 40 being opened, as more particularly described below with reference to figure 3, thus to permit exhausted fluid from the rod end 23 of the actuator 18 to flow into the first supply line 30 to augment the supply of fluid from the selector valve means 25, resulting in less fluid being demanded from the pump 26.

Thus piston 19 movement in the cylinder 20 may continue fully to lower the landing gear 11 or 12.

The presence of the by-pass restrictor 36 in the line 34 between the rod end 23 and the selector valve means 25 allows fluid flow from the line 34 when the check valve 40 is closed so that there is no risk of residual uncirculated fluid preventing the piston 19 from moving through its full range.

Typically, a mechanical or other sensing arrangement is provided which may interface with an interlock which operates mechanically to retain the landing gear in its fully lowered condition and may cause the selector valve means 25 to assume the rest position R once the landing gear 11 or 12 is fully lowered. In the rest condition R, fluid may flow from the first and second supply lines 30, 34 to tank 27 so that the system is unpressurised when the landing gear 11 or 12 is in a fully lowered condition and the pump 26 is indicated.

When the selector valve means 25 is moved to the rest position R, the check valve 40 will be closed by the action of a return spring 42 or the like.

When it is desired to raise the landing gear 11 or 12 the selector valve means 25 may be moved to the second position II in which pressurised fluid is fed to the second supply line 34 through the one way valve 35 to the rod end 23 of the actuator 28, and the piston 19 will be moved to begin retraction of the landing gear 11 or 12. Where there is an interlock mechanically to retain the landing gear in a lowered condition, this needs to be released before the piston 19 can move. Such release may be arranged to occur simultaneously with selector valve means 25 movement.

Fluid which is exhausted from the head end 22 of the actuator 18 may flow freely past the one way valve 32 in the first line 30, to tank 27 via the selector valve means 25. The check valve 40 will remain closed when the selector valve means 25 is in the second condition and there is no exchange of fluid between the two lines 30 and 34. However, when fluid is supplied to the second supply line 34, a portion of the fluid is bled to a pilot line 39 which flows to the check valve 40 and operates to maintain the check valve 40 in the closed condition.

As the landing gear 11 or 12 fully retracts, an uplock may be operated mechanically to hold the landing gear in its raised condition. At the same time, the selector valve means 25 may be moved to the rest position R so that again, the hydraulic system is unpressurised when the landing gear 11 or 12 is in its stowed condition.

Referring now to figure 3 a particular example of a check valve 40 is illustrated.

The check valve 40 has a valve body 50 in which there is provided a valve passage 51. The passage 51 contains a valve member 52 which is movable in the passage 51 into and away from engagement with a valve seat 54, towards one end 60 of the passage, and a valve piston 55. The valve piston 55 has a larger cross sectional area than the valve member 52, and accordingly

In figure 3, the connections to the hydraulic system of figure 2 are intimated. In figure 2, there is shown a line 70 from the first supply line 30 to the check valve 40 to intimate that the check valve 40 responds to sufficient fluid pressure in the first supply line 30. In figure 3 though, there is intimated a line 71 from the second supply line 34 to the check valve 40. In both cases because there is a pressure rise as the landing gear 11 or 12 is lowered because fluid cannot freely flow from the rod end 23 of the actuator 18, the check valve 40 will be opened.

Referring again to figure 3, when such pressure rise is experienced in the second supply line 34 and line 71, this will be communicated to the face 74 of the valve member 52 and will lift the valve member 52 off the seat 54. Thus during lowering of the landing gear 11 or 12, fluid may flow past the valve member 52 from the second line 34 into the first supply line 30 to augment the supplied fluid.

When fluid is supplied under pressure to the second supply line 34 to raise the landing gear 11 or 12, a pilot pressure is delivered to the check valve along line 39 and acts to urge the valve piston 55 away from its stop 58 and against the force of the coil spring 56 until the valve piston 55 engages the valve member 52 to urge the valve member 52 firmly onto the seat 54, notwithstanding high supply fluid pressures exerted on the face 74 of the valve member 52, because the valve piston 55 are of on which the pilot pressure acts, is greater than that of the valve member 52.

Various modifications may be made without departing from the scope of the invention.

Particularly, the check valve 40 described with reference to figure 3 is only an example of a check valve suitable for the purpose of allowing fluid expelled from the actuator 18 to augment the flow of fluid to the actuator.

The various components of the hydraulic system have been described as separate components although it will be appreciated that multiple components may be provided e.g. in a common valve block. Thus the one way valves 32, 35 and/or the restrictor means 36 and/or the flow control means 31 may be provided in a common valve block together or not with the check valve 40 and possibly the selector valve means 25 too.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any

CLAIMS

1. A hydraulic system for raising and lowering aircraft landing gear, the system including an actuator which is extendible and retractable to operate the landing gear, the actuator including a movable member in a casing, the movable member being moved relative to the casing in a first direction to extend the actuator when fluid under pressure is supplied to a first side of the movable member whilst fluid is exhausted from a second side of the movable member, and the movable member being moved in a second direction to retract the actuator when fluid under pressure is supplied to the second side of the movable member whilst fluid is exhausted from the first side of the movable member, and there being selector valve means selectively to supply pressurised fluid to the first or second side of the movable member, characterised in that means are provided to permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member

2. A system according to claim 1 characterised in that the means which permit exhausted fluid to augment the supplied fluid includes a check valve which is opened as the movable member of the actuator moves relatively in the casing in the first direction to extend the actuator and lower the landing gear.

3. A system according to claim 2 characterised in that the check valve opens to permit exhausted fluid from the second side of the movable member to augment the supplied fluid in response to the pressure of the fluid supplied to the first side of the member or in response to a pressure build up in a passage carrying exhausted fluid from the second side of the movable member.

4. A system according to claim 2 or claim 3 characterised in that closure means are provided positively to close the check valve when pressurised fluid is supplied by the selector valve to the second side of the movable member.

5. A system according to any one of the preceding claims characterised in that means are provided to relieve exhausted fluid which is not recirculated from the at least one of the first and second sides of the movable member as the movable member reaches the end of travel in the casing.

6. A hydraulic system according to any one of the preceding claims including a first fluid supply line to the first side of the movable member for supplied fluid from the selector valve means when the selector valve means is in a first position, and a second supply line to the second side of the movable member for supplied fluid from the selector valve means when the selector valve means is in a second position, and the means which permit exhausted fluid from at least one of the first and second sides of the movable member to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member, permitting the exhausted fluid to flow from the second supply line to the first supply line.

7. A system according to claim 6 characterised in that the second supply line includes non-return means at least to restrict the flow of exhausted fluid from the hydraulic system.

12. A valve including a valve member and a piston each received in a passage in a valve body, the valve member and piston being biased apart by resilient means such that the valve member is urged towards a valve seat towards one end of the passage, and the piston is urged towards a stop towards an opposite end of the passage, a fluid inlet and a fluid outlet, the pressure of fluid at the inlet when sufficient, acting to move the valve member against the force of the biasing means off the valve seat to permit fluid flow from the inlet, past the valve seat, to the outlet, and the piston being movable in the passage away from the stop in response to a pilot pressure delivered to a pilot pressure port of the body against the force of the biasing means to a position in the

passage in which the piston engages the valve member and restrains the valve member against movement off the valve seat in response to the inlet pressure.

13. A valve according to claim 12 characterised in that means are provided to permit fluid pressure at the outlet to be communicated to an intermediate region of the passage between the valve member and the piston at least when the piston is engaged with the stop.

14. A valve according to claim 13 characterised in that the outlet opens into the valve passage and there is a flow path for the fluid under at the outlet past and/or through the valve member to the intermediate region when the valve member is in engagement with the valve seat.

15. A valve according to any one claims 13 to 14 characterised in that the valve is a check valve to permit the flow of exhausted fluid from at least one of the first and second sides of the movable member of the actuator of the hydraulic system according to any one of claims 1 to 11 to augment the supplied fluid from the selector valve means and thus be directed with the supplied fluid, to the second or first side respectively of the movable member.

16. A valve substantially as hereinbefore described with reference to and as shown in figure 3 of the accompanying drawings.

17. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

ABSTRACT

A hydraulic system for raising and lowering aircraft landing gear (11, 12) includes an actuator (18) which is extendible and retractable to operate the landing gear, the actuator (18) including a movable member (19) in a casing (20), the movable member (19) being moved relative to the casing (20) in a first direction to extend the actuator (18) when fluid under pressure is supplied to a first side (22) of the movable member (19) while fluid is exhausted from a second side (23) of the movable member (19), and the movable member (19) being moved in a second direction to retract the actuator (18) when fluid under pressure is supplied to the second side (23) of the movable member (19) while fluid is exhausted from the first side (22) of the movable member (19), and there being selector valve (25) selectively to supply pressurized fluid to the first (22) or second (23) side of the movable member (19), and a check valve (40) to permit exhausted fluid from at least one of the first (22) and second (23) sides of the movable member (19) to augment the supplied fluid from the selector valve (25) and thus be directed with the supplied fluid, to the second (23) or first side (22) respectively of the movable member (19).

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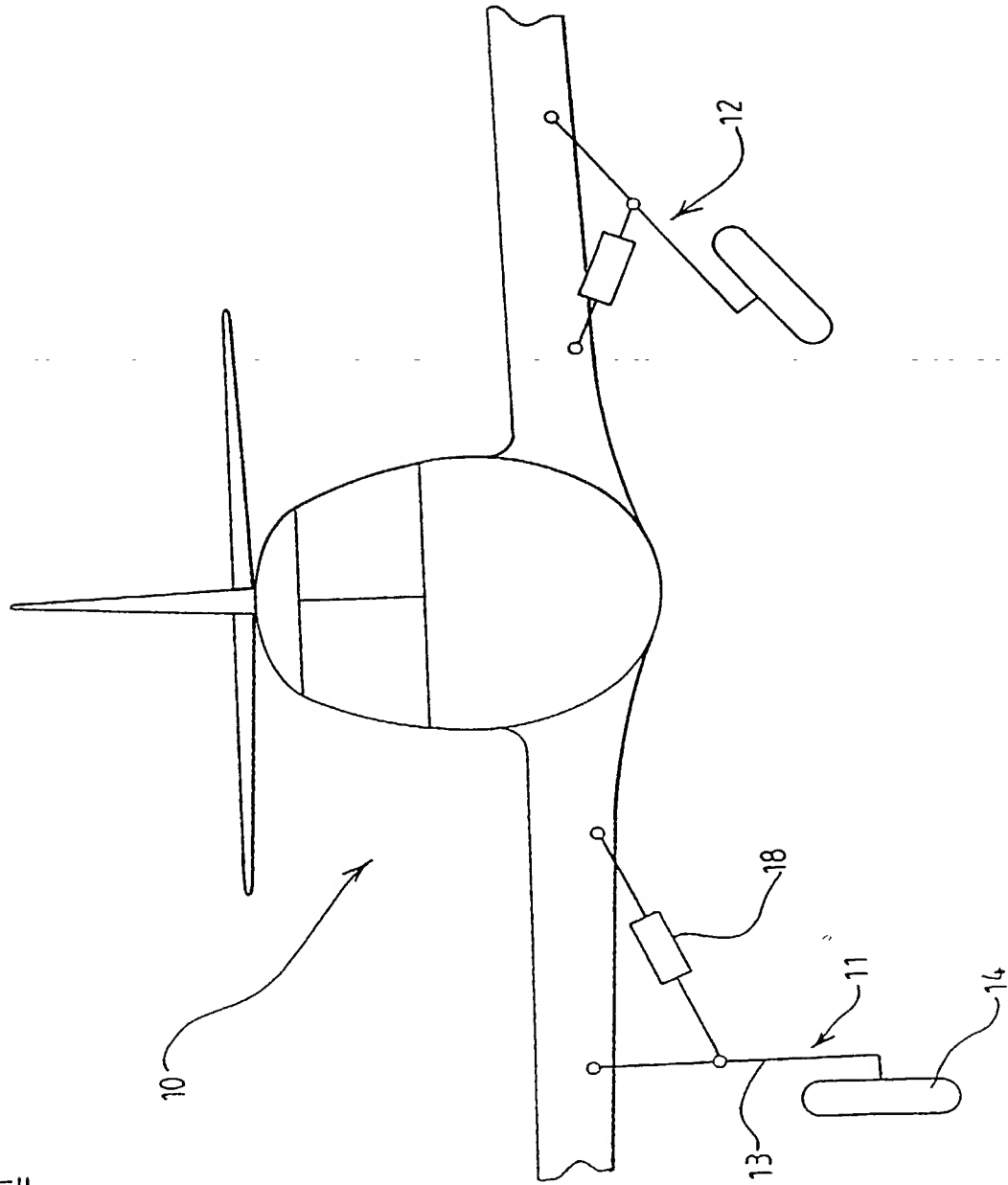


FIG 1

2 / 3

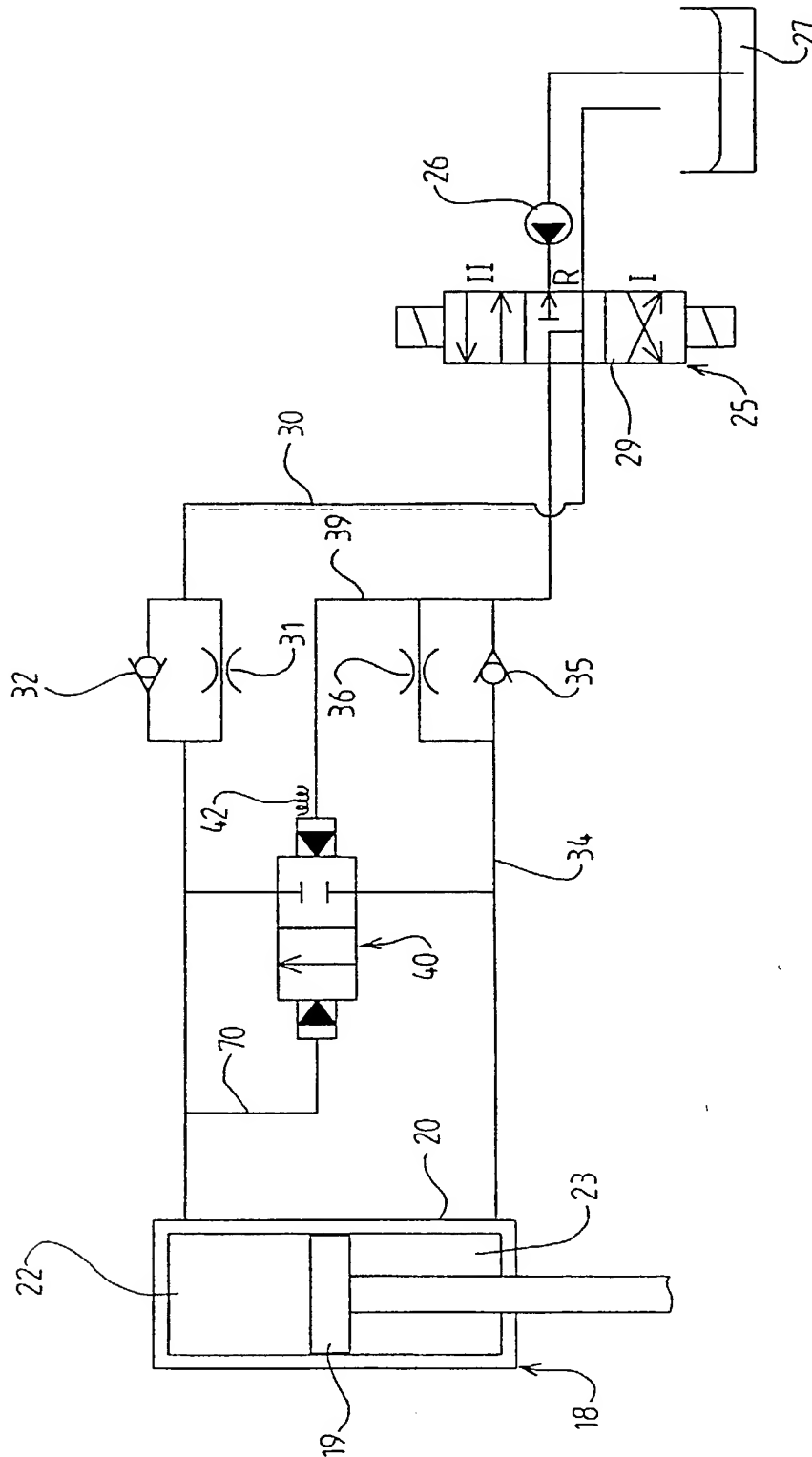
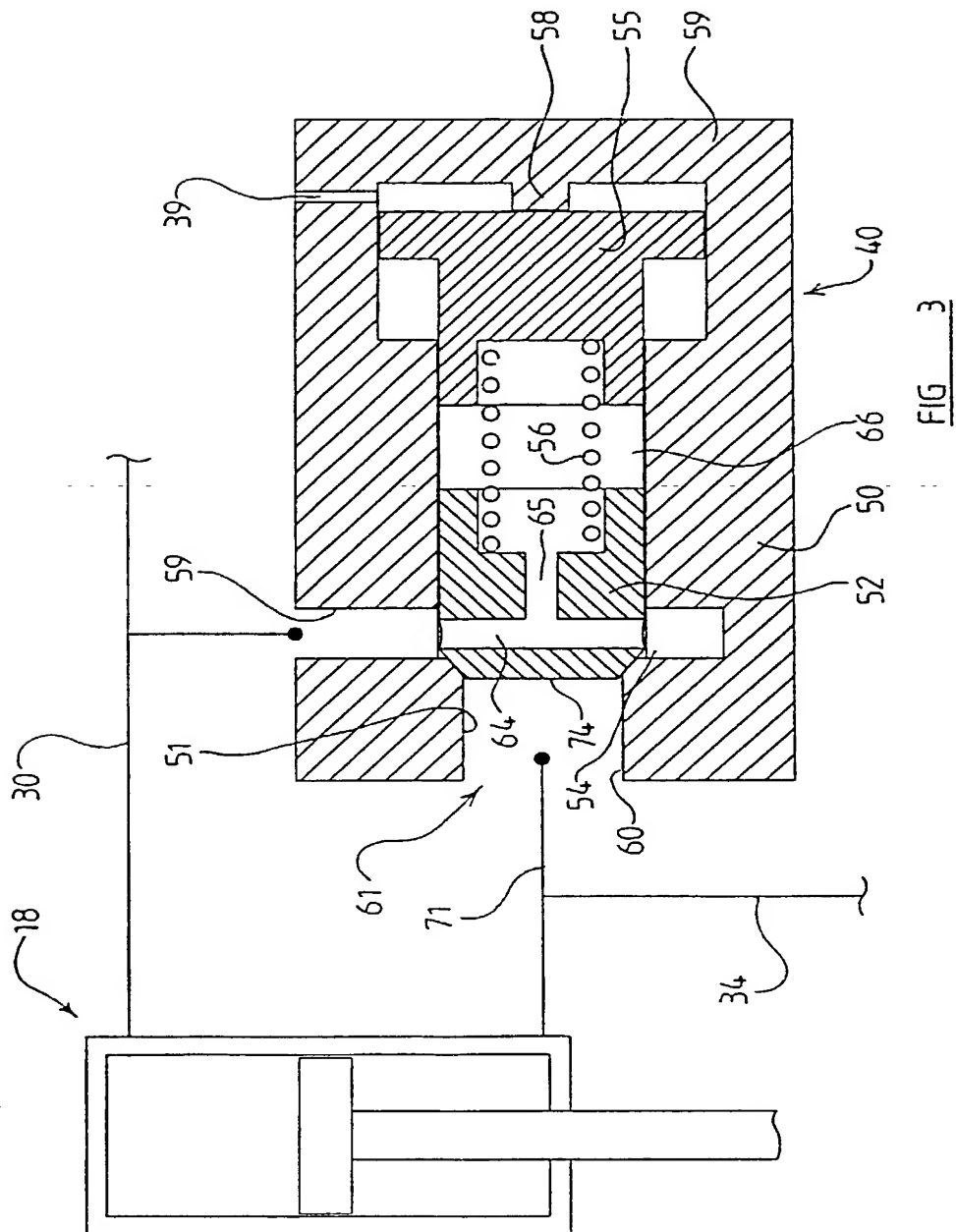


FIG. 2

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Atty. Docket No. 06007/38331 4989705

DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "Hydraulic System for Aircraft Landing Gear," the specification of which (check one): ☐ is attached hereto; ☒ was filed on April 3, 2002 as Application Serial No. 10/089,947 and was amended on _____ (if applicable); ☐ was filed as PCT International Application No. PCT/GB00/02853 on 25 July 2000 and was amended under Article 19 on _____ (if applicable). I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

			Priority Claimed	
			<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
<u>PCT/GB00/02853</u> (Application Serial Number)	<u>International</u> (Country)	<u>25 July 2000</u> (Day/Month/Year Filed)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<u>9923620.0</u> (Application Serial Number)	<u>United Kingdom</u> (Country)	<u>7 October 1999</u> (Day/Month/Year Filed)	<input checked="" type="checkbox"/>	<input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Application Serial Number) (Day/Month/Year Filed)

(Application Serial Number) (Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

(Application Serial Number) (Day/Month/Year Filed) (Status-Patented, Pending or Abandoned)

(Application Serial Number) (Day/Month/Year Filed) (Status-Patented, Pending or Abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

[illegible]

37 CFR 1.56. DUTY OF DISCLOSURE - INFORMATION MATERIAL TO PATENTABILITY (Applicable Portion)

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentability defines, to make sure that any material information contained therein is disclosed to the Office.

Information relating to the following factual situations enumerated in 35 USC 102 and 103 may be considered material under 37 CFR 1.56(a).

35 U.S.C. 102. CONDITIONS FOR PATENTABILITY: NOVELTY AND LOSS OF RIGHT TO PATENT

A person shall be entitled to a patent unless --

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
- (c) he has abandoned the invention, or
- (d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or
- (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraph (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or
- (f) he did not himself invent the subject matter sought to be patented, or
- (g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

35 U.S.C. 103. CONDITIONS FOR PATENTABILITY; NON-OBVIOUS SUBJECT MATTER (Applicable Portion)

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

35 U.S.C. 112. SPECIFICATION (Applicable Portion)

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

POWER OF ATTORNEY: I hereby appoint as my attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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